REMARKS

Initially, Applicant states that it has carefully reviewed the disclosure and has made amendments to correct minor typographical errors contained in the specification and claims. No new matter has been added.

In paragraph 3 of the Office Action the Examiner objected to the drawings under 37 C.F.R. § 1.83(a) for failing to show "the LED, the wavelength converter, the sensor or the switch" and stated that these items where essential for a proper understanding of the disclosed invention according to MPEP §608.02(d). In addition, the Examiner objected under 37 C.F.R. § 1.84(p)(5) because reference character 22 in Figure 4 is not mentioned in the specification. Reconsideration is requested.

The items that the Examiner has listed as essential for a proper understanding of the invention are not a part of the invention, but are merely demonstrations of the potential applications of the invention. There is no necessity for demonstration of these items because they are not "essential features" of the invention as defined by MPEP §608.02(d). Requiring their appearance in the drawings would be akin to requiring a drawing of a computer when the claimed invention is a microchip that can be used in anything from calculators to cars to coffee pots. These items are not being claimed by the present invention, but are only being described as possible applications. Therefore it is requested that the 37 C.F.R. § 1.83(a) rejection be withdrawn.

Applicant is grateful to the Examiner for pointing out the error contained in Figure 4. Reference character 22 should read 12. Antecedent basis for this correction can be found in the specification page 13, lines 9-19, which gives a description of the layers in the present invention. A drawing correction is attached hereto with corrections in red ink.

In paragraph 4 of the Office Action the Examiner rejected Claims 1-29 under 35 U.S.C. § 112, second paragraph as confusing, vague and indefinite, and Claims 1-17 as reciting an optical device without the recitation of any structure to support the device. Reconsideration is requested.

Applicant has amended the claims to recite the inclusion of an active or non-linear material operatively associated with the plurality of voids as part of the optical structure. The disclosure required for this amendment can be found, *inter alia*, in the specification at page 11, lines 7-16 and at page 7, line 26-page 8, line 8. Applicant

submits that the active and non-linear materials provide different optical structures, with the active material providing an emitter for such devices as a laser, an LED, a waveguide, etc., and the non-linear material being used in switches, etc.

The recitation of a metal layer having a first surface with defined voids operatively associated with the active or non-linear material provides the required structure, and is sufficiently definite and properly claimed.

Moreover, since the claimed structure for processing optical energy can be used in a variety of devices, the particular device in which it appears need not be included in the claim. In this regard, Applicant wishes to point to Boysel et al., U.S. Pat. No. 5,278,925, (herein after Boysel et al.). Applicant agrees that Boysel et al. describes analogous art (although lacking in its disclosure to anticipate or render obvious the present invention, discussed below) and the claims similarly refer to structure that does not include the optical device in which the structure is applied.

The structure described and pictured in figures 1a-9b of Boysel et al. consists of the substrate, an electrode, a lower cladding, a core, an optional buffer layer, an upper cladding, and a metal membrane (col. 2, line 45 to col. 3, line 3, and figures 1a to 9b). Applicant wishes to highlight that the particular device (i.e. LED, laser, etc.) in which the structure of claim 1 of Boysel et al. is used is not a claimed element. Additionally, although a substrate for the metal layer of the present claimed invention can be used, it is not required. The differences between the Boysel et al. structure and that of the present claimed invention will be discussed in detail later, but the parallel between the method of claiming the structure and the method of claiming the present invention (which the Examiner has recognized by citing Boysel et al. as prior art), demonstrates that a lack of structure is not a proper objection.

Additionally, it is believed that the claims are not "confusing, vague and indefinite" in that one skilled in the art can understand that the invention comprising a metal layer, the surface of the metal layer having voids with a dimension less than the wavelength being processed, operatively associated with an active or non-linear material. Furthermore, amendments have been made to correct typographical errors, to ensure the clarity of the pending claims.

Turning to the substantive matters raised, in paragraph 6 of the Office Action the Examiner rejected Claims 1-4, 6, 7, 12-19, 22-25 and 28 under 35 U.S.C. §102(b)

as being anticipated by Boysel et al., (U.S. Pat. No. 5,278,925) (hereinafter "Boysel et al."). Reconsideration is respectfully requested.

Boysel et al. describes an integrated optic waveguide device. The structure consists of a substrate, an electrode, a lower cladding, a core, an optional buffer layer, an upper cladding, and a metal membrane (col. 2, line 45 to col. 3, line 3, and figures 1a to 9b). The waveguide device operates by the passing of electricity though the electrode, which in turn pulls the metal membrane towards the substrate layer altering the path in which light may pass through the spacer layer (the upper cladding in the preferred embodiment). This induces controllable changes on the light, which can then be adapted for implementation (col. 3, lines 4-20).

In additional embodiments, Boysel et al. alters the light being passed though the waveguide device by changing the configuration of the substrate layer by adding ridges and columns as well as altering the configuration of the metal membrane (col. 3, lines 43-53). The holes disclosed in Boysel et al. pass completely through the metal membrane. This is a required condition of the holes because it is the only way taught in which the spacer layer can be etched out (page col. 3, lines 31-36).

In sharp contrast, the present invention uses voids to enhance emission and absorption of optical energy (see Summary of the Invention). There is no electrode causing an alteration of the distance between the metal layer and the substrate as in Boysel et al. The optical effects of the present claimed invention are caused by altered refraction caused by the particularly defined voids in the metal layer, not electromagnetism as in Boysel et al.

More specifically, the prior art does not contain any reference to an invention as claimed wherein the voids have a dimension less than the wavelength of the optical energy being processed. Although the Examiner's citation to Boysel et al. column 2, lines 63-64 includes a metal membrane with holes (not voids), it does not contain any reference to the size of the holes and especially not to a dimension that is in relation to the wavelength of the optical energy being processed. In fact, there is no reference to such a size limitation anywhere in the Boysel et al. reference.

Significantly, the limitation of voids in the surface of the metal layer having a dimension less than the wavelength of the optical energy being processed creates an unanticipated result in the enhancement of the wave effect. As set forth at page 5, lines

25-31 of the specification, it is expected that a sub-wavelength sized hole will not transmit light very effectively. However, it has been surprisingly found that the propagating surface plasmon indicates a higher than expected transmission of optical energy. Since the limitation to the size of the voids on the metal surface is contained in all of the present claims, either directly in the independent Claims 1, 18, 28, 29 and 30, or via dependency on either Claim 1 or 18. Therefore, all claims are believed to be patentable over the Boysel et al. reference.

Moreover, the voids of the present invention, which may or may not pass through the metal layer, may be filled with or have adjacent thereto an active or non-linear material. In the embodiment comprising voids in the form of an aperture, the material may be placed between the substrate and the metal layer (page 10, line 6 to page 11, line 16). The filling of the voids with active or non-linear material alters the refractive index of the components of the present invention inducing an effect on the light, which can be controlled by alteration of the metal layer or the material (as well as other possible alterations) (page 10, line 6 to page 11, line 16). This control then lends itself to many applications, which are described it the specification and known in the prior art.

In paragraph 7 of the Office Action the Examiner rejected Claims 5 and 9 under 35 U.S.C. §103(a) as being unpatentable over by Boysel et al. Reconsideration is respectfully requested.

As discussed above, Boysel et al. does not anticipate or render obvious Claim 1 and therefore the reference cannot render Claims 5 and 9 obvious, since they are dependent on Claim 1. In addition, there is no motivation in Boysel et al. to make the alterations necessary to achieve the present invention. Therefore, removal of the rejection under §103 is requested.

In paragraph 8 of the Office Action the Examiner rejected Claims 10-11 and 20-21 under 35 U.S.C. §103(a) as being unpatentable over by Boysel et al. in view of Bischel (U.S. Pat. No. 6,208,791)(hereinafter Bischel et al.). Reconsideration is respectfully requested.

As discussed above, Boysel et al. does not anticipate or render obvious Claims 1 or 18 and therefore it cannot render Claims 10-11 and 20-21 obvious, since they are dependent on either Claim 1 or 18. Furthermore, the citation to Bischel, col. 4, lines

36-38 does not overcome the deficiencies of Boysel et al. Earlier in the patent there is a discussion of re-radiator material that "protrudes above the top surface of the waveguide" (col. 4, lines 7-10), however, there is no metal layer or description of a wavelength dimensional correlation between the "pit" (as described in Bischel et al.) and the optical energy being processed.

Therefore, as discussed above, Boysel et al. does not anticipate or make obvious claims 1 or 18, and Bischel et al. cannot be relied upon to cure the deficiencies of Boysel et al. to render the present invention obvious as a whole. In addition, there is no motivation in the cited references for a combination to achieve the present invention, and therefore the rejection should be removed.

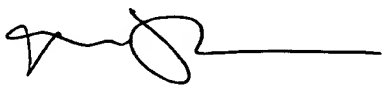
In paragraph 9 of the Office Action the Examiner rejected Claim 29 under 35 U.S.C. §103(a) as being unpatentable over by Boysel et al. in view of Biegelsen et al. (U.S. Pat. No. 5,607,876) (hereinafter Biegelsen et al.). Reconsideration is respectfully requested.

As discussed above, Boysel et al. does not anticipate or render obvious Claim 1. Claim 29 is an independent claim, however, it includes all the limitations of Claim 1 and is therefore not anticipated or made obvious by the cited prior art. Additionally, the disclosure of an LED in combination with Boysel et al. does not render Claim 29 obvious. The LED is an application of the present invention set forth in the present claims coupled with a patentable limitation. The LED is not set forth as a feature of the item being claimed, it is the application in which the present invention is set forth. As such, Claim 29 is not rendered unpatentable by the cited references.

Based on the above amendment and remarks, applicant respectfully submits that all of the pending claims are now allowable over the prior art and that they are in proper form for allowance.

Favorable consideration and early allowance of all of the pending claims is respectfully requested and earnestly solicited in light of the foregoing.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

In the Abstract:

A structure and method of enhancing optical emissions and optical energy comprising a metal layer having [an] a first surface comprising a plurality of voids, said voids having a dimension less [then] than the wavelength of optical energy being processed.

Page 5, lines 25-31:

According to diffraction theory, a sub-wavelength sized hole will not transmit light very effectively. However, the measured transmission efficiencies are of an order unity, whereby efficiency is defined as the ratio of fractional transmission to a real fraction of the holes. The propagating surface plasmon (SP) was associated with the higher than expected transmission of optical energy.

Page 6, line 29-page 7, line 6:

The use of voids in metals is also relevant to the surface enhanced Raman scattering [effect] (SERS) effect. There is an important difference in local field effects depending on whether the excited material is adjacent a concave or a convex metal surface. At a convex metal surface, like a metal nanoparticle, the field lines diverge rapidly and the field drops off rather quickly (see Figure 1 hereto). At a concave surface, by contrast, the field will not drop off nearly so quickly and may stay constant or enhanced from a lensing effect. This is seen in a field of a dielectric sphere immersed in a uniform electric field, where the field inside the sphere is constant.

Page 14, lines 19-25:

Various embodiments derived from the above description will be apparent to those skilled in the art, including modifications based on the above. All such variations and modifications are intended to fall within the spirit and scope of the present structure limited solely by the appended claims. All publication referred to herein are incorporated by reference.

IN THE CLAIMS:

1. (amended) An optical structure for processing optical energy comprising a metal layer having a first surface comprising a plurality of voids having a dimension less [that] than the wavelength of optical energy being processed and an active or non-linear material operatively associated with at least a portion of the plurality of voids.

10. (amended) The structure of Claim 1 wherein [an] the active or non-linear material is placed adjacent the voids.

11. (amended) The structure of Claim 1 wherein [an] the active or non-linear material is placed inside said voids.

12. (amended) The structure of Claim 1 wherein [said gain] the active or non-linear material is in the form of a layer [is placed] on top of said metal layer.

13. (amended) The structure of Claim 1 [further comprising] wherein the active or non-linear material comprises one or more [gain] active or non-linear layers placed between a substrate and said metal layer.

15. (amended) The structure of Claim 1 wherein [a] the active or non-linear material is placed at least partially in the voids.

16. (amended) The structure of Claim 1 wherein [a] the active or non-linear material fills the voids.

18. (amended) A method for optical processes comprising directing optical energy at a first surface of a metal layer, said surface comprising one or more voids having a dimension less than the wavelength of optical energy being processed and an active material operatively associated with at least a portion of the plurality of voids.

28. (amended) A laser comprising a metal layer having a first surface comprising a plurality of voids, said voids having a dimension less [then] than the wavelength of optical energy being processed and an active material operatively associated with at least a portion of the plurality of voids.

29. (amended) An LED structure comprising a metal layer having a first surface comprising a plurality of voids, said voids having a dimension less [then] than the wavelength of optical energy being processed and an active material operatively associated with at least a portion of the plurality of voids.

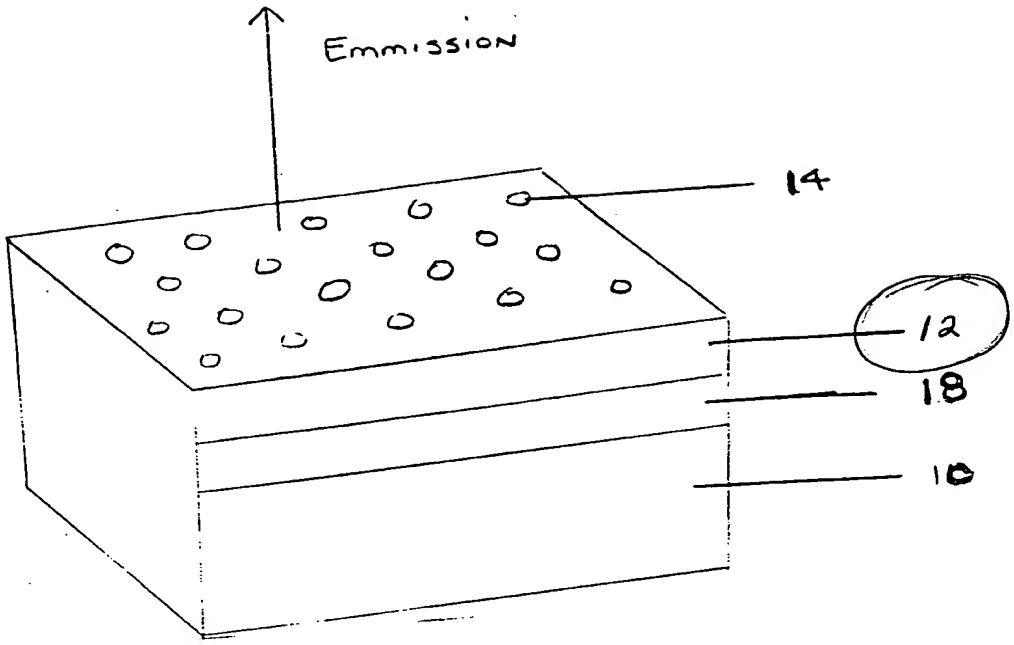

FIGURE 4